

SCIENCE.

FRIDAY, SEPTEMBER 24, 1886.

COMMENT AND CRITICISM.

THERE IS NO MORE IMPORTANT SUBJECT for both thought and action than the wholesomeness of the milk-supply of our large cities. It has been estimated that in the city of Brooklyn the daily consumption of milk amounts to 152,575 quarts. A considerable part of this forms the sole food of thousands of children and invalids, and it is therefore of the greatest importance that it should be of the highest degree of purity attainable. The influences at work to deteriorate milk are manifold. The cows themselves may be affected with tuberculosis or some other form of disease which may by the medium of the milk be communicated to its consumer, or the sanitary condition of the stable in which these animals are confined may be so defective as to render the atmosphere impregnated with filth and the germs of decomposition, which act most perniciously upon the milk. In speaking on this subject before the Massachusetts medical society, Dr. B. F. Davenport called attention to the readiness with which milk will absorb impurities, and also to the fact that the milk which is delivered in Boston is, at the time of its delivery, nearly three days old, and that it has been exposed to such a probability of contamination as to be practically on the very point of souring. He attributes no inconsiderable part of the summer diarrhoea to this changed condition of the milk. Dr. Davenport believes that the difference in the coagulation of human and cow's milk in a child's stomach is owing to the difference in their chemical reaction; that of cows being acid, and the other neutral or slightly alkaline. If milk could be served to the consumers on the same day of its production, and in a condition free from all impurities, there is no doubt that this would be an important factor in reducing the sickness and death of the infantile population.

PROF. E. C. PICKERING, the director of the Harvard college observatory, has put forth a pamphlet in which he broaches a scheme which may result in much advantage to the astronomical world, and in time to the outer world, which is slowly

but surely benefited by all progress in science. The premises from which Professor Pickering starts are these: observatories with good instruments but no funds to pay observers, and good astronomers with no instruments or money to get them. Like all schemes of this day, Professor Pickering's is one of consolidation. He would have a fund raised the income of which should be available for paying the cost of astronomical work, whether it be done at Harvard, at the Lick observatory, or in Europe, — no matter where, so long as the workers were fit for their labor. As Professor Pickering is cognizant of the good results obtained with the Elizabeth Thompson fund for scientific investigation in general, being one of the trustees, we judge he must be encouraged to employ the same method in his own field. The plan as given in the pamphlet is one deserving the attention of all able to aid scientific work.

The Lick observatory, although so well equipped, is a case in point. Of the \$700,000 given by Mr. Lick, \$500,000 have been expended for the 'plant.' Although the whole plan of the observatory has been made with direct reference to keeping its running expenses low, it is clear that the company of astronomers will have to be kept small. It would require a staff of at least ten astronomers to return the full results from the outfit, and at present not more than three can be employed. The work of these must be concentrated on the large equatorial, and even then their energies will not be sufficient to utilize every moment. Now, this is Professor Holden's plan, and we suspect he was hard-pressed to devise it: "We mean to put the large telescope at the disposition of the world by inviting its most distinguished astronomers to visit us one at a time, and to give to them the use of the instrument during certain specific hours of the twenty-four. Each day there will be certain hours set apart when the observatory staff will relinquish the use of the equatorial to distinguished specialists who will come from the United States and from Europe to solve or to attack some one of the many unsolved problems of astronomy. In this way we hope to make the gift of Mr. Lick one which is truly a gift to science, and not merely a gift to California and to its university."

IN A RECENT NUMBER of *Science* it was stated that cholera did not seem to be very active in Italy, although it had extended thence to Trieste and Fiume. From here it has invaded Carmola and Croatia. At Lie, a village of Croatia, it seems to have awakened to new life, developed doubtless by reason of the unsanitary condition in which it has found the inhabitants of that place, some nine hundred in number. Although it seems to have but just appeared in that place, ninety persons are reported as having contracted the plague, of which number twenty-eight are already dead. It will be seen from this that the disease must be of a very virulent type. The excitement among the people is said to be intense and uncontrollable. The scenes which were enacted in Spain during the epidemic which ravaged that country are being repeated in Croatia. The physicians are being stoned, and wives and children deserted. The superstition of these people is so great that almost any form of barbarity may be expected. The matter begins to have a serious aspect for central Europe, when cholera in a virulent form has obtained so firm a foothold in Austria; and, if the disease continues to spread, something like a panic may be anticipated. If the report of the appearance of cholera at Pesth is confirmed, the danger is greatly increased, as the onward march of this epidemic disease is greatly favored, when it reaches cities situated upon rivers which are great highways of travel.

THE FEVER which broke out in Biloxi, Harrison county, Miss., in August last, has occasioned great excitement and alarm throughout the length and breadth of the Mississippi valley. The opinion was expressed by us at that time, that it was undoubtedly yellow-fever. This was based upon our knowledge of the skill and experience of Dr. Joseph Holt, president of the Louisiana state board of health, who declared the disease to be of that nature. This opinion has been controverted by the physicians of Biloxi, which is not a matter of surprise, and also, as appears in the daily press, by the physicians of the U. S. marine hospital service. We have just received from Dr. Holt a detailed account of the outbreak and its subsequent history, and are more convinced than ever that the citizens of Biloxi have had true yellow jack in their midst, and that, if the disease is now under control, that result has been attained by the vigorous action of the Louisiana board in

instituting a quarantine against the infected city. Had this not been done, the existence of the fever would probably have been concealed until it had obtained such a hold that months rather than weeks would have elapsed before it was conquered. It is a sad commentary on human nature, that not only the people, but even medical men and officials, will attempt to delude themselves into the belief that a pestiferous disease does not exist in their midst, simply to avoid the risks to reputation and commerce which a knowledge of the true state of things would create, when they must know, from an experience which has been repeated over and over again in the past, that concealment or suppression can at best avail nothing, and that such a policy can but result in a wide-spread and probably uncontrollable epidemic, which will cause untold suffering and misery, and increase the mortality a hundred-fold.

THE BRITISH ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

THE British association meeting is now drawing to a close, and may be said to have been very successful in all respects, but without any great sensation. About twenty-five hundred tickets have been taken for it, and the local arrangements were most complete. A special feature in them is a large exhibition of the manufactured products of this so-called 'workshop of the world.' Great care has been exercised in the selection of the exhibits, which must have been produced within a radius of fifteen miles from the centre of the town, and they illustrate in a remarkable degree the applications of science and art to manufacturing processes. A very large number of firms have also thrown open their works to the inspection of visitors. An unusual number of colonial and American visitors are attending the meeting, among the latter of whom Professor Barker and Prof. Carvill Lewis, both of Philadelphia, are prominent figures. The president, Sir W. Dawson of Montreal, opened the meeting with an address upon "The geology of the Atlantic Ocean and the land on its borders," which, together with the addresses of Prof. G. H. Darwin, president of the section of mathematics and physics, and of Mr. Crookes, president of the chemical section, will be found in full in *Nature* for Sept. 2. The subject of the former was "The value of the unit of geological time, from the point of view of cosmical physics." Mr. Crookes dwelt, in somewhat hypothetical fashion, it is true, with the genesis of the chemical elements, and he suggested a process for their evolution by the gradual cool-

ing of primordial matter termed 'protyle' (analogous to protoplasm), which contained within itself the potentiality of all possible atomic weights. The keynote of the presidential address by Professor Bonney to the geological section was contained in the phrase, "the application of microscopic analysis to discovering the physical geography of bygone ages." In the biological section Mr. Carruthers, the president, drew attention to the past history of those species of plants which still form a portion of the existing flora. Sir F. Goldsmid, who presides over the geographical section, took for his subject "The means of popularizing the study of geography," a contribution to which end is seen in an exhibition of appliances therefor, open during the meeting. In the section of economic science and statistics, Mr. J. Biddulph Martin, in his presidential address, gave an exposition of the claims of this subject to a scientific status. In that of mechanical science, the president, Sir James N. Douglas, dealt with the peculiarly appropriate subject of lighthouses, since probably the largest manufactories of lighthouse apparatus in the world are to be found in Birmingham. Lastly, in the anthropological section, Sir George Campbell recommended from the presidential chair the systematic and scientific cultivation of man with a view to both physical and mental qualities, — 'homi-culture,' in the same sense as oyster-culture, bee-culture, etc.

Turning to the general work of the meeting, it may be remarked that there were, at its commencement, between six hundred and seven hundred papers to be read and discussed in these various sections. Geology seems the most prolific, that section being almost overburdened with work. Two subjects for special discussion were selected some months ago : 1°, 'The theory of color-vision ;' 2°, 'The nature of solution.' The latter was confined to the chemical section, but the former was conducted at a joint meeting of the physical and biological ; and it was remarked at the outset that on no previous occasion had two sections held a joint discussion. The result was so successful, that it is hoped this precedent may be followed. No formal papers were read, but the subject was opened by Lord Rayleigh, who, in a speech of some length, reviewed the theory from the physical point of view. Colors might differ in three ways, — brightness, freedom from dilution with white, and hue : hence, from any four colors and black, a match might be made. He insisted very strongly on the distinction in effect between mixing colors (or paints) and mixing lights. No other known colors than red, violet, and green were 'primary,' though it was possible that some other unknown tints might be the real primary

colors. In the so-called color-blindness, color-vision was usually twofold, or dichroic. All that he said, however, involved the assumption (probably true) that a mixture is more complicated than its ingredients. Dr. König of Berlin followed with an account of a large series of very careful experiments upon elementary sensations of color, — an analysis of color-sensations without any hypothesis, — which led him to the conclusion that the views of Thomas Young as to color, viewed in the light of modern experimental research, were certainly true. Dr. Michael Foster, speaking from the physiological point of view, pointed out to the physicists the difficulty of applying their theories of color, and expounded Hering's theory, according to which colors might be divided into pairs, one of which produced assimilation in the substance of the retina, and the other dissimulation, such as blue and yellow, red and green, and so on. Mr. J. Tennant pointed out that both Hering's and Young's theories had three independent variables, and led to the same general results. As, however, Hering's unquestionably explained the phenomena of simultaneous contrast best, he preferred it on that ground. The discussion came to a premature end, from lapse of time. That upon the nature of solution was opened by Dr. Tilden, who had studied the subject mainly from the point of view of the thermal phenomena occurring at solution. He presented an able summary of our knowledge of the subject, and showed that the solubility of a salt depended mainly on its melting-point, as well as on similarity of constitution between it and the solvent. Dr. Nicol showed experimentally that the molecules of a salt stood in the same relation to all the molecules of the water in which it was dissolved, or, in other words, that salts did not retain their water of crystallization in solution. Dr. Armstrong, Mr. Hartley, and Dr. Gladstone, however, differed from this view, considering that the hypothesis of 'residual affinity,' broached by Helmholtz, afforded a sufficient explanation of observed facts.

At one of the general evening meetings, Professor Rucker delivered a brilliant lecture to a very large audience, upon 'Soap bubbles.' The experimental illustrations, all of which were projected on a screen by the electric light, were of exceeding beauty and invariably successful. The particular point brought before the audience was the thickness and other properties of the black film of the bubble. The unit of measurement employed was the millionth of a millimetre. It was shown that this thickness varied considerably, but that the optical and electrical methods of measurements agreed closely in any particular

case. Generally these black films range from 7.2 to 14.5 units in thickness, so that from 4 to 720 molecules could lie side by side therein, according to the view of the size of molecules adopted. A very extraordinary phenomenon was the sharply marked edge of the black film, a sudden and not a gradual increase of thickness taking place, between it and the colored film. The influence of surface tension and viscosity upon this was discussed, and the important influence of these researches upon the dynamical theory of liquids was insisted upon; the lecturer, who quoted Sir William Thomson in support of his views, considering that in this sharp edge there was experimental evidence, first, of a minimum of surface tension; and, secondly, of an alteration of the nature of force in play between the molecules, which had often been assumed in physical investigations, but of which direct evidence had hitherto been wanting.

A day was devoted to the consideration of electrical subjects from the mechanical or engineering side. A warm discussion took place upon the relative merits of electric light and mineral oil for lighthouses, the general result being, that, even for lights of a low order, the electric light could compete most favorably in every point, as to efficiency, first cost, and cost of maintenance. The balance of evidence brought forward was unquestionably on the side of the electric light as regards fog penetration. On the question of secondary batteries, some remarkable evidence was adduced as to the improvements in detail lately effected therein, which rendered them more practically permanent, and free from disintegration. The most important subject, however, was that of electric safety-lamps for miners' use. Mr. Swan exhibited his latest form, which fulfilled all the conditions laid down two years ago for the Ellis Lever prize. The lamp was self-contained, and, with a current of 0.4 amperes, gave the light of one candle for twelve hours: it weighed five pounds and a half, and its secondary battery was much more simply recharged than an ordinary Davy lamp. Moreover, a most ingenious fire-damp indicator, accurate to within 0.5 per cent, was attached to it. Mr. Swan claimed that it was more efficient, more safe, and more economical, than any miner's lamp in use.

At the general committee meeting held Sept. 6, Sir Henry Roscoe was elected president for the meeting to commence at Manchester on Aug. 31, 1887, and it was agreed to meet in Bath in 1888. An invitation from the government of New South Wales was received for forty or fifty representative members of the association to be present at Sydney in January, 1888, when the centenary of the colony would be celebrated. It was resolved

to entertain the invitation; and the council was empowered to accept it, if, after due inquiry, they were of opinion that a sufficient number of truly representative men would agree to go.

On the night of Sept. 6 a lecture was given to the whole association by Professor Rutherford, who broached that night for the first time what might be termed a 'telephonic theory' of hearing. According to it, the cochlea does not act on the principle of sympathetic vibration, but the hairs of all its auditory cells vibrate to every tone, just as the drum of the ear does; there is no analysis of complex vibrations in the cochlea or elsewhere in the peripheral mechanism of the ear; the hair-cells transform sound-vibrations into nerve-vibrations similar in frequency and amplitude to the sound-vibrations; simple and complex vibrations of nerve energy arrive in the sensory cells of the brain, and there produce, not sound again, of course, but the sensations of sound, the nature of which depends, not upon the stimulation of different sensory cells, but on the frequency, amplitude, and form of the vibrations coming into the cells, probably through all the fibres of the auditory nerve. On such a theory the physical cause of harmony and discord is carried into the brain, and the mathematical principles of acoustics find an entrance into the obscure region of consciousness. Now, if nerve energy were only electricity, that theory would probably be accepted at once; but nerve motion is very sluggish when compared with electricity. The lecturer for five years had kept this theory back, because he felt that he had no evidence of the possibility of sending a rapid succession of vibrations along a nerve. It cost him a good deal of thought and experimental observation to find the evidence he required. In dealing with methods so difficult and obscure, one must beware of dogmatism; but it was the duty of the scientist to frame theories which seemed to explain phenomena. One might and often did err in holding back a theory lest it should give pain to the author of some theory which it was destined to oppose, forgetting that the suggestion of a new line of thought might in some other mind lead to ideas still farther in advance. Should his theory of the sense of hearing find acceptance, it would lead to a reconstitution of theories regarding the other sense-organs. The lecture was successfully illustrated by means of an extensive and elaborate collection of apparatus and diagrams.

THE authorities of Nancy, France, have voted to add 300,000 francs to the 500,000 francs already appropriated by the general government, to be devoted to the construction of chemical and anatomical institutes in that city.

SOME FEATURES OF THE RECENT EARTHQUAKE.

SOME knowledge of the local topography and geology in the vicinity of Charleston is essential to a complete understanding of the effects of the great earthquake.

The seaboard portion of the coastal plain, upon which Charleston, Summerville (twenty-one miles to the north-west), and the other towns most seriously affected by the recent catastrophe, are situated, is a nearly uniform plain from ten to thirty or forty feet in altitude, slightly inclined seaward, and diversified by broad, irregularly meandering, and inosculating troughs and pond-like depressions from five to fifteen feet deep. The depressions, or 'low-grounds' as they are termed colloquially, are frequently swampy, and toward the ocean merge into the tidal channels of the coast; but, when above the reach of the tide, they are lined with a rich semi-alluvial soil, either supporting luxuriant arboreal vegetation, or producing abundant crops; while the uplands constituting the plain proper (the 'high-grounds' or 'pine-barrens' of the rural population) have a light, sandy soil little charged with humus, and are naturally forested, chiefly with pine. This slightly accented topography is not the product of sub-aerial erosion and deposition, but was fashioned by oceanic waters as the land emerged from the sea; the high-grounds representing the slightly sloping beaches, and the low-grounds the tidal canals and estuaries, of an epoch during which the land stood from ten to thirty feet lower than now. Summerville is an aggregation of suburban residences irregularly scattered about in a pine-forest on the uplands, and is probably the most elevated point in its longitude between Cooper River on the north-east and the Ashley on the south-west. Ten-Mile Hill (midway between Charleston and Summerville) is on the eastern margin of the same upland, overlooking an irregular depression connecting these rivers; while Charleston is located on the extremity of a peninsular prolongation of the plain, bounded on the north-east and south-west respectively by the Cooper and Ashley rivers, which, by reason of the seaward tilting, is elevated but a few feet above tide.

The geologic structure is remarkably simple, and when the formations have been thoroughly investigated, and definitely correlated with those of other portions of the coastal plain, will doubtless be found wonderfully uniform over a considerable area. The superficial deposit in the uplands is obscurely stratified, fine yellow sand or (rarely) mottled clay reaching a depth of from five to fifteen feet. Beneath this member, and

frequently immediately beneath the soil in the low-grounds, occurs a bed of fine clayey sand or silt, generally bluish in color. This stratum commonly contains sulphurets and various salts, either free or quickly liberated on oxidation. It is from ten to thirty or forty feet thick; the precise thickness being difficult to determine, partly because of the local thickening due to depressions in the subjacent surface, and partly because of the impossibility of separating it from the superjacent member: indeed, the superior sand appears to differ from this mainly in the greater amount of oxidation which it suffered. In the low-grounds, and along the coast generally, these sands are overlain or replaced by estuarine alluvium consisting of fine blue silt or clay, locally designated 'pluff mud;' for the land is now subsiding (and apparently most rapidly south-westward), and sedimentation is advancing upon the land. Beneath these superficial deposits occurs the commonly recognized 'marl-bed,' at the summit of which the South Carolina phosphates are found. The superior strata of this marl-bed in some isolated areas have been referred to the later tertiary by Holmes and others; but by far the larger portion of the mass represents the formations made classic by Tuomey under the names of 'Ashley and Cooper beds' and 'Santee marls.' These formations consist of a somewhat variable but nevertheless remarkably uniform succession of marls, clays, and sands, extending to a depth of about six hundred feet where they are underlain by petrographically similar cretaceous deposits, increasing in heterogeneity somewhat downward to two thousand feet below the surface. At this depth a good supply of artesian water has been obtained. The structure at greater depths is not certainly known; but, according to Hall, the fossils from the lowest strata reached by the artesian borings indicate that a considerable thickness of cretaceous strata are infraposed, while there is reason to believe that these, in turn, rest on pre-cretaceous beds.

To one traversing the disturbed area, the effects of the earthquake are themselves no more conspicuous than the indications of inequality and intensity, and variability in character, of the disturbance; and it is this phase of the subject that will be dealt with in the following paragraphs.

1. From the early commencement (Friday, Aug. 27) and the long duration (up to date) of the seismic disturbance at Summerville, from the frequent repetition and great intensity of shocks, from the frequency of detonations and their simultaneity with tremors, and from the vertical direction of the vibrations, that place may be regarded as the centre of disturbance. The predominant effects of the shock of Aug. 31 are,

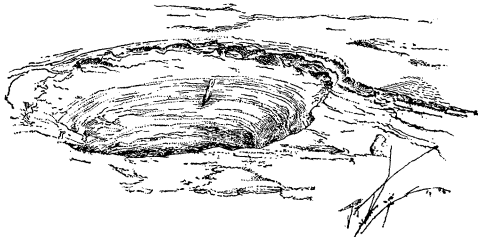


FIG. 1. — CRATERLET AT TEN-MILE HILL.

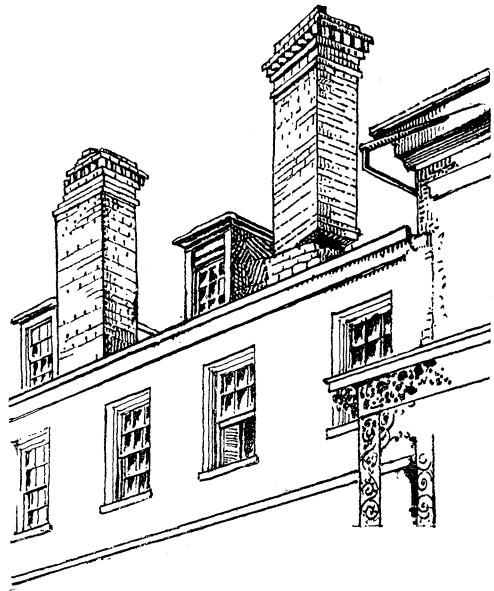


FIG. 3. — TORSIONALLY DISPLACED CHIMNEY IN CHARLESTON.

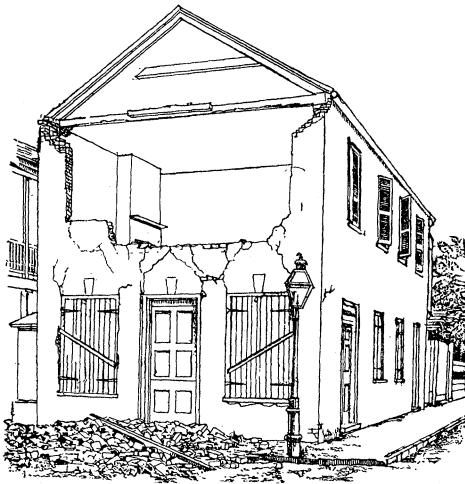


FIG. 2. — DISPLACED GABLE IN CHARLESTON.

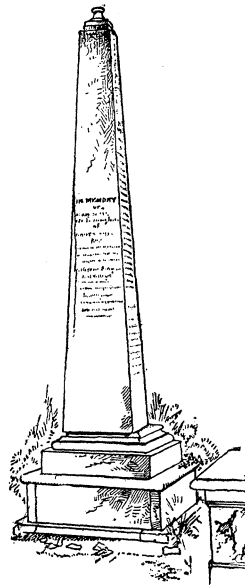


FIG. 4. — DISPLACED MONUMENT IN CHARLESTON.

first, fissuring of the surface of the earth; and, *second*, crushing of foundations and chimneys; together with, *third*, slight displacement in different directions (and sometimes torsional) of buildings.

The fissures are irregularly distributed throughout the village and over the surrounding plain. They are generally confined to the high-grounds, but appear to reach maximum abundance about the peripheries of the more elevated lands. They are so numerous that sometimes not an acre in a square mile is free from them, and, three days after the great shock, were two inches and less in width, and from four or five feet to as many hundreds in length. From the testimony of the citizens, as well as from the sand and mud stains in their vicinity, it appears that sand-laden water welled from these fissures in vast volumes, and continued to flow for some hours, and even, in some cases, days: indeed, water was observed to flow freely from one on the highest ground in Summerville up to the fifth day after the great shock during which they are said to have been formed. The local streams were flooded by the water from these fissures, and the floods had not completely subsided a week afterward. The sand and clay washed from them was evidently derived mainly from the uppermost member of the superficial deposits, although in some cases the blue sand of the inferior member predominates. These fissures extend in all directions, and occasionally cross and bifurcate at various angles.

The architecture in Summerville is characteristic: the houses are generally of wood, lightly framed, either partially or wholly surrounded by wide verandas, and supported on slender pillars from four to six feet high, either of wood set in, or of brick built upon, the ground; while the chimneys usually rest on independent brick columns built up from the ground. Few if any of them have suffered injury, save by the great shock of Aug. 31; and the injury to the houses themselves is astonishingly slight, and generally confined to racking of frames, shaking down of plastering, and occasional crushing of roofs by falling chimneys. Much injury was done, however, to furniture, which was overturned, tossed about, and in many cases broken. When the supporting pillars were of wood, the buildings have sometimes been displaced, and the entire structure, including the supports, has evidently swung to and fro in all directions, as indicated by the annular crevices surrounding the pillars; and in such cases the chimneys have almost always toppled over, generally to the north or south, the direction having been determined to a large extent by the slopes of roofs. When, however, the supports were of brick,

they have been crushed at top and bottom, and fissured obliquely in all directions, as if by blows of a pile-driver, and in some cases the pillars have been driven into the ground, depressing and concentrically fissuring the surface about their bases. The crushing of the pillars is invariably greatest beneath the heaviest parts of the building: indeed, in some cases the heaviest pillars have completely collapsed, and the buildings are now supported by the piers beneath the verandas and the lighter parts of the floors. The heavy bases of the chimneys are similarly crushed and fissured; and in numerous instances they, too, have completely collapsed, and all that portion of the chimney beneath the roof has crumbled down into a mass of loose bricks, sometimes leaving the projecting portion intact and in place upon the roof. An example of the manner in which structures have been crushed vertically with little lateral displacement is found in the centre of the village of Summerville, where two apparently fragile chimneys, left in position when the building to which they were attached was destroyed by fire years ago, have been crushed and obliquely fissured, but have not been overturned, or displaced laterally to the slightest degree.

The writer experienced half a dozen or more shocks in Summerville, and heard four or five times that number of detonations. The individual shocks were of very brief duration: the longest observed (and from the testimony of the citizens it appears that this was second in severity only to the great shock of Aug. 31) was over in less than thirty seconds. The motions of furniture, etc., during this shock, were carefully noted. It was found, that, during the first two-thirds of its period, the vibration appeared to be directly vertical; that a wrenching, torsional motion, turning objects in the direction of the sun, followed; and that this was succeeded by a few gentle east-and-west rolls. The movements were identical in all the lighter shocks, when of sufficient duration to permit of observation, save in intensity. Ordinarily, however, the lighter shocks were simply spasmodic quivers of but an instant's duration, the direction of which it was impossible to determine. The shocks were invariably accompanied by sensibly simultaneous detonations resembling slightly muffled thunder-peals or heavy cannonading, commonly compared by the older residents, who remembered the bombardment of Charleston, to the booming of 'siege-guns' a mile or two away; but the detonations were three or four times as frequent as the tremors. It may be mentioned that no two individuals, even among trained observers, agreed as to the direction whence the sound came. This fact, and the simultaneity of

detonation and observed tremor, together suggest that the sound came directly from the earth, either as sonorous vibrations, or as soundless pulsations of such period as to be converted into sound-waves on passing from earth to air.

2. The principal physical record of the great shock at Ten-Mile Hill is found in the craterlets, or 'sand-spouts,' which there attain maximum size and abundance. They are simple circular or elongated orifices from which water has welled forth with such violence as to flood the entire surface over hundreds of acres to depths of from one to two or more feet, to carry out hundreds of tons of the yellow and blue sand overlying the marl-bed, and to spread this sand over scores of acres to depths varying from a fraction of an inch to two or three feet. These crateriform orifices are now surrounded by their solid ejecta in annuli attenuating peripherally, in which the shrinking streams from the dwindling fountains have worn channels and gullies, as shown in fig. 1; and most of them are now filled with water up to within a foot or two of the natural surface. By residents the waters are reported to have gushed forth during, and for some hours after, the great shock, sometimes by jets but generally continuously, to the height of trees; and, since they sometimes contained sulphurous compounds, they gave out characteristic odors that added much to the terror of the people. The volume of water extravasated was sufficient to flood many of the minor drainage-ways above even the highest freshet-marks; and five days after the great shock, water still flowed from some of the craterlets, and yet retained the odor of sulphuretted hydrogen. There is no indication that the orifices extend, or that the water flowed from, below the base of the superficial sands (in which the mean depth of permanent ground water is ten or fifteen feet), either at Ten-Mile Hill or elsewhere; and, indeed, at the phosphate-works nearest Ten-Mile Hill, in the immediate vicinity of which both fissures and craterlets occur, the marl-bed was so slightly disturbed at depths of sixty or seventy feet, that the water slowly percolating into the shafts was neither increased nor discolored. Nevertheless, these fountains, issuing from a surface fifteen feet above the level of ground water, the flow from fissures here, at Summerville, and to a less extent at Charleston, and the rise of waters in wells in various localities, all point to sudden and considerable contraction, either vertical or horizontal, of the water-bearing sands overlying the marl. 'Sinks' are, indeed (rarely), associated with the craterlets; but they appear to have been formed after the subsidence of the extravasated floods.

In the vicinity of Ten-Mile Hill, too, the kink-

ing and distortion of railway-tracks is most striking. In a number of cases the rails were so bent as to necessitate removal; the displacement in alignment sometimes reading two feet or more, while that in profile was half as great. It should be mentioned, that, in all personally observed and well authenticated cases of compressive distortion of rails, the kinks occurred in the low-grounds at the bottoms of inclines, and generally in the vicinity of trestle-bridges approached by embankments, and that at least a part (and in one case all) of the contraction relieved by the kinking appears to have been caused by the down-hill settling of rails, ballasting, and embankment. Nevertheless, longitudinal fissures in the embankments, and lateral throw of the track, have evidently been produced directly in some cases: and near Ten-Mile Hill a locomotive was derailed (with destruction of life) during the second shock; but whether by the tremor, or as a result of antecedent displacement of the track, could not be ascertained. In general terms, the injury to the few buildings at Ten-Mile Hill is similar to that exhibited at Summerville, save that the horizontal displacement has been greater, chimneys have been more generally overthrown, and the plastering of the ceilings is less seriously, and that of the walls more seriously, cracked and dislodged.

It is noteworthy, that, between Ten-Mile Hill and Charleston (perhaps three miles from the latter place), there is a considerable area or zone in which the effects of the earthquake are inconspicuous: chimneys have seldom been overthrown, buildings are not displaced on their foundations, the foundations themselves are not crushed, and plastering is but slightly injured. Even the tall brick chimneys of the fertilizer-works within the area appear to have escaped injury.

3. As has already been made known through the daily press, the most conspicuous effect of the seismic disturbance at Charleston was the lateral displacement and overthrow of chimneys, monuments, walls, entire buildings, etc. These records of the great earthquake have been examined and noted with care, with the view of applying Mallet's method of determining the origin and paths of the seismic tremors to the region affected thereby. The observations on injured buildings may be briefly generalized as follows:—

1. The throwing outward of walls, gables, cornices, copings, etc., is most common in walls facing north, next in those facing south, third in those facing east, and least in those facing west.
2. By far the greater number of overthrown chimneys have fallen either to the north or south, and more to the north than the south.
3. The most seriously cracked walls are those facing east;

those facing west are nearly as seriously injured ; those facing south follow, but are much less injured than the two former ; and those facing north are least injured, but only slightly less than the southerly walls. 4. When corners of buildings are thrown out, they have gone most frequently to the north-east, next to the south-west, third to the north-west, and least frequently to the south-east. So many isolated observations are inconsistent with these generalizations, however, that little value can be attached to them. Similar inconsistencies are observed in the behavior of the marble and granite shafts in marble-yards and cemeteries. Of those which have been overturned, the larger number have been thrown either to the north or south, but some have gone in various other directions ; many have suffered torsional displacement, but of these some have turned with others against the sun ; while others are displaced laterally without overthrow, and in as many directions as there are compass-points. Chimneys, too, have been twisted both with and against the sun, and during their oscillations have 'walked' in various directions. A Charleston chimney twisted with the sun, and slightly displaced southward, is shown in fig. 3 ; and a neighboring monumental shaft turned in the opposite direction, and displaced north-eastward, is represented in fig. 4. Perhaps the discrepancies among these observations may eventually be eliminated, and the apparent confusion reduced to order ; but for the present, inferences as to the azimuth of the wave-paths in Charleston and immediate vicinity are premature.

It is remarkable that the intensity of the seismic action has varied greatly within the limits of the city of Charleston. Thus in certain quarters the buildings have escaped with trifling injury, while similar and similarly oriented buildings in other quarters have been completely destroyed ; and all possible intermediate phases of injury are found in different parts of the city. The numerous observations on the variable intensity of the disturbance in Charleston and elsewhere in South Carolina have not yet been collated and digested ; but it would appear that there are large areas within which the intensity of the disturbance culminated (and Charleston is one of these), and, moreover, that within these areas themselves there are foci or nodes of maximum vibration circumscribed and separated by annuli in which the disturbance was less severe.

A few fissures, such as those abounding at Summerville, occur in Charleston and vicinity, and some small craterlets have also been observed in the neighborhood.

A number of slight tremors were experienced in

Charleston. They differed from those felt at Summerville, 1°, in less intensity and greater duration ; 2°, in direction, which was manifestly more nearly lateral than vertical, though the azimuth was not accurately determined ; and, 3°, in the absence of detonations or other sounds than such as might be attributed to movements in furniture, in neighboring buildings, etc. •

Briefly, it appears, that within a radius of a dozen miles somewhere near the centre of the district affected, and within an area of remarkably uniform topographic configuration and geologic structure, the effects of the recent earthquake are quite diverse : viz., that at Summerville the principal effects are crushing of structures in the vertical direction, and the formation of fissures with the outflow of a considerable volume of water ; that at Ten-Mile Hill, half-way between that point and Charleston, the principal effects are local deformation of the surface and the extravasation of a great volume of sand-laden water, with combined crushing and lateral displacement of structures ; and that in Charleston the predominant effects are lateral displacement in various directions (without vertical crushing) and overthrow of structures, torsional displacement and overturning in different directions of monuments, together with some fissuring of the surface and the extravasation of small quantities of water.

W. J. MCGEE.

COMPRESSED AIR ON CABLE-ROADS.

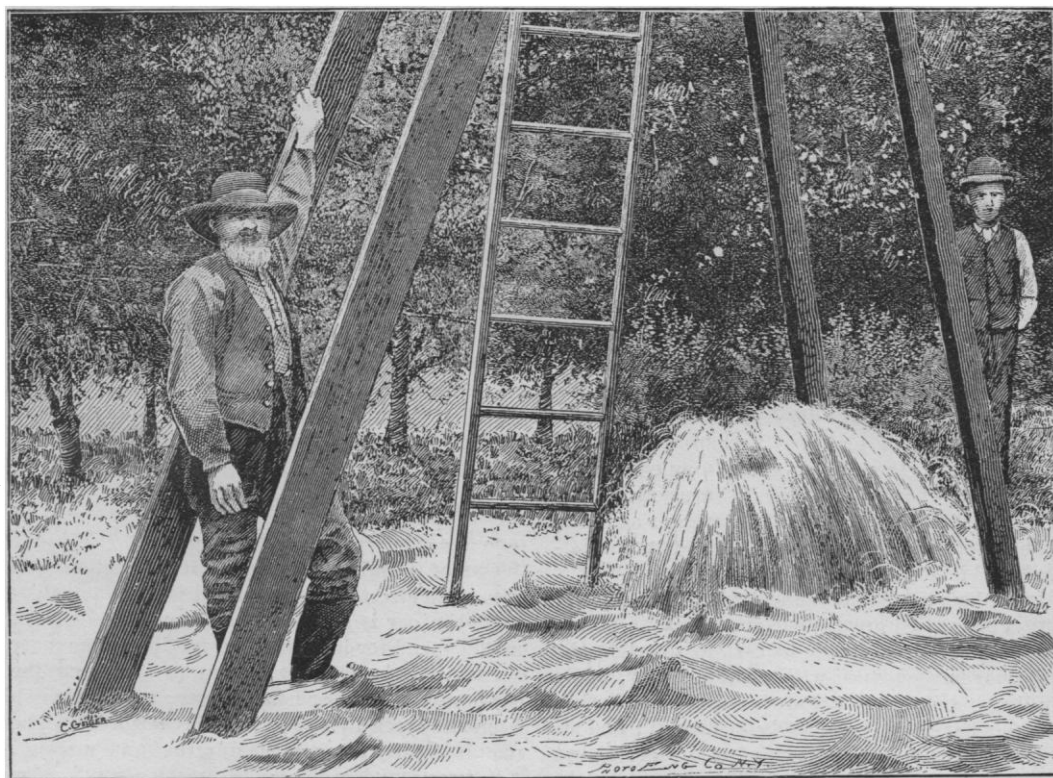
ONE of the minor annoyances in connection with the cable street-railway system is the fact, that, until the car is gripped to the moving cable, it must depend for its motive power upon some other agent ; that is, it must be run to and from the car-house by hand or horse power ; and switching from one track to another at the termini of the road is usually accomplished in the same manner. To dispense with this extra motive power, by making each car temporarily self-propelling, is the object sought in a series of experiments now in progress on the Tenth Avenue cable-road in this city. The experimental car is fitted with a small air-compressor, an air-engine, and several cylindrical air-tanks, placed beneath the body of the car. The compressor is connected by a clutch with one of the car axles ; and the engine or motor is connected in a similar manner, though with the addition of an intervening train of speed-reducing gear-wheels. On a recent trial trip, the air-tanks were filled to a pressure of about five atmospheres, at the car-house, by means of a compressor. The driver, or grip-man, then opened the valve admitting air to the engine, and the car propelled itself

steadily and smoothly out of the car-house, around a curve, and over a switch to the main cable-track. Here another device, intended to lessen the labor of the grip-man, was brought into play. Air was admitted to a small cylinder on the grip, causing the latter to close firmly upon the cable, and the car sped on its way, up and down hill, out to the terminus at Fort George. The brakes were also operated by means of the compressed air acting upon a separate brake cylinder. To stop the car, the grip was let go, the air-brake put on, and, if

depend, of course, upon the economic results attained by extended trials in actual use.

THE ARTESIAN WELL AT BELLE PLAINE, IOWA.

SIMULTANEOUSLY with the report of the recent earthquake came sensational stories of an artesian eruption at Belle Plaine, Io., and speculation at once connected the two events with each other, and with renewed geyser activity in the Yellowstone park and seismic movement on the opposite



ARTESIAN WELL AT BELLE PLAINE, IOWA.

the pressure-gauge showed much decrease of pressure, the compressor-clutch was thrown into gear, thus utilizing the motion of the car to renew the supply of compressed air. The compressor was put into action also, to keep the pressure at the proper point; so that, with a little additional work thrown on the cable, the car always held in reserve sufficient motive power to work the grip and brakes, as well as to run switches and to propel itself to or from the car-house. The trial trip, though it revealed some defects in the mechanism, was essentially a success. The general adoption of this or similar devices upon cable-roads will

hemisphere, as factors of a common disturbance of the earth's crust. Without reposing faith in such broad hypotheses, it seemed worth while to investigate the artesian phenomenon for its own sake.

The more sensational elements of the accounts were found to be chiefly the work of a romancing reporter whose moral faculties present the only similitude of seismic disturbance the case affords. The well is indeed phenomenal in some respects, but these are surely of the artesian order, and entirely without mystery. The following are essentially the facts:—

Last spring it was incidentally discovered that

flowing wells could be obtained by deeply boring into the drift. Six wells were put down, varying from 210 feet to 301 feet in depth, wholly in drift, and without reaching its bottom. Five of these flowed, while the water in the sixth, which was on higher ground, came within three feet of the surface. These wells gave clear evidence of a common source which had an effective head of from 70 to 80 feet above the now famous well. This latter was the seventh attempt, and was located on ground from 15 to 30 feet below the five then flowing. A three-inch well was contracted for, but only a two-inch well sunk; the driller intending to take advantage of the wash of the current, and force in a three-inch pipe. Out of this rose the trouble. As in the preceding wells, only drift was penetrated. The record is defective in detail, and perhaps in precision, but doubtless represents the general truth: soil, 4 feet; yellow clay, 10 feet; fine sand, 16 feet; gravel, 18 feet; blue stony clay, 145 feet; sand and gravel in which flow was struck, depth unknown; total, 193 feet.

In the other wells, beds or pockets of sand were struck in the blue clay; and the subsequent history of this well makes it probable that they were present here also. A flow of water was obtained at the base of the blue clay in sand and gravel. Pieces of wood and other vegetal remains were brought up by the current. This also occurred in the other wells, indicating the presence of one of the 'Old Forest beds.'

The flow was struck Thursday evening, Aug. 26, and, though strong, was in due proportion to the preceding ones. On Friday, in attempting to force in the three-inch pipe, the water broke a passage outside of it, which it rapidly enlarged until a vast volume of water poured forth, inundating the street and adjoining lots, bearing with it much sand and some pebbles, among which a great variety of northern rocks were represented.

The eruption of water was impressive because of its volume, but not because of the height of its ejection. Instead of 'several hundred feet,' or any thing excusing such an absurd exaggeration, photographs show it to have been about waist-high when unconfined, and about shoulder-high when a sixteen-inch pipe was inserted in the endeavor to control it. At present writing (Sept. 9) it wells up vigorously, but does not form a jet. The minimum diameter is now not less than 3 feet; a cone of that dimension, inserted in the effort to govern the flow, having been pushed through to the bottom without entirely cutting off the current outside of it. The more trustworthy estimates of the volume during the higher stages range from 9,000,000 to 5,000,000 gallons per

diem. My own data for Sept. 9 indicate a flow of about 3,000,000 gallons.

The other flowing wells promptly felt the effects of this lower and more capacious outlet, and declined steadily. The record of one is given as follows: on Monday morning, Aug. 30, three days and a half after the great well started, it ceased to flow; on Wednesday at 6 P.M. it had fallen 7 feet; Thursday evening it had fallen 23½ inches in 24 hours; and measurement Friday morning showed a fall still at the rate of about 1 inch per hour. All wells but one had ceased flowing prior to Sept. 8, and this I found then sinking at about 5 inches per diem. It is evident that the great well obtains its supply from the same subterranean body as these, — the lower water-filled stratum of sand and gravel, — and that it is rapidly drawing this off. It has already lowered its head at least two-thirds of the whole. It must continue to decline in the force of its flow until the discharge is reduced to equality with the supply, when it will settle into equilibrium. It will then indicate the maximum amount of permanent flow, a knowledge of which will be of service in its future utilization. This particular method of arriving at that fact is not, however, to be recommended for general use.

I infer that the elevated portion of the saturated stratum, forming the reservoir, is not very large, else even the great flow would not draw the head down so rapidly. Assuming a discharge of 5,000,000 gallons and a lowering of the head 5 inches per day, and taking no account of inflow, the reservoir indicated has a clear surface of less than 40 acres. A mixture of sand and gravel may easily contain one-fourth its volume of water, as may be shown by experiment; but, assuming one-tenth, the upper edge of the water-bearing stratum need not exceed 400 acres in extent. It is not therefore necessary to suppose any unusual subterranean source, either in area or kind. Nor is it necessary to suppose a distant origin. The head is not greater than could be supplied by the country adjacent on the north, which is the probable supply-ground.

It is simply a flowing drift well, run rampant for want of control. It has its phenomenal feature in its magnitude, and its lesson in its expensive and destructive career through injudicious handling. When it has drawn off its head, it can probably be put under control — which it has thus far defied — without serious difficulty, and the drained wells restored.

That it has no causal connection with the earthquake is evident from its character and the fact that it broke forth three days earlier.

T. C. CHAMBERLIN.

NOTES AND NEWS.

So much has been said of late about the dangers of producing tuberculosis in the human subject by means of the milk of cows having this disease, that it would seem that there was nothing more to add. Bang of Copenhagen, however, calls attention to a new source of danger in these cases. He finds that the udder itself is not infrequently the seat of this disease, and that the milk produced by such a gland is capable of infecting animals fed upon it. The necessity of having competent veterinarians to examine critically all milch-cows is becoming daily more apparent; and a board of health that neglects such examination is aiding materially in the propagation of this disease, which must be regarded as one of the principal factors in the mortality of our population, both in city and country.

—The operation of tracheotomy, by which an opening is made with the knife into the windpipe for the relief of membranous croup and diphtheria, seems likely to be superseded by intubation of the larynx. In this new operation a small tube is inserted through the mouth into the windpipe, and all necessity for a cutting operation is thus avoided. It is claimed by the advocates of this method of treatment that it is far easier to introduce this tube than to perform tracheotomy, and that more lives are saved than by the old operation. The statistics which are given in the medical journals go far to confirm their opinions, and, as the process is being generally introduced, but little time will be necessary to substantiate the claims made for it.

—At the first exposition of the Iowa weather-service, recently held, there was shown a selection from the large amount of graphical material that has accumulated at the central station. At future exhibitions it is proposed to present instruments and other elements of the service.

—G. P. Putnam's Sons (New York) have published 'The life of Robert Fulton,' by Thomas W. Knox. The book is one full of anecdote, and will prove to be interesting to many a boy. It tells the story of one of America's most remarkable inventors, whose head, from youth on, was "so full of original notions that there was no room to store away the contents of dusty books."

—Prof. J. C. Faye of Appleton, Wis., has published through Van Nostrand a "Handbook of mineralogy, for the determination, description, and classification of minerals found in the United States." Professor Faye was induced to write this book through the success of his 'Mineral tables,' which quickly passed through two editions.

—*The American journal of biology*, a quarterly edited by H. D. Valin, M.D., is announced. The contents of the first number are, 'The laws of life outlined,' 'Evolution of life,' 'Origin of flowers,' 'Nature of animal colors,' 'Nature of light,' 'Development of the eye,' 'Nature of sight,' 'Origin of walnuts,' 'A ballade of evolution.' The journal is published by the American journal of biology publishing company, 802 South Halsted Street, Chicago.

—It is claimed, that, whenever an acute abscess forms, two varieties of micro-organism will invariably be found in the pus, —*Staphylococcus pyogenes* and *Streptococcus pyogenes*.

—Some years ago great expectations were excited by the claims which were made that the Eucalyptus globulus would banish malaria from the land, if only planted in abundance in malarious regions. Extensive plantations were accordingly made, but, so far as known, the result was a total failure. Dr. Brandes of Hanover now advocates, with a similar object in view, the growth of the *Anacharis alsinastrum*, a water-plant which is exceedingly common in some sections of the country. He bases his proposition upon the fact that in the district where he lives fevers of a malarial type were very prevalent until this water-plant was introduced, and that they diminished from year to year until four years ago, when they entirely disappeared, and have not since returned. As the *Anacharis* is easily obtained and grows spontaneously, requiring no attention, the experiment can be easily tried in marshy districts where malaria prevails.

—In China there is a curious device to make record of earth-tremors. It is of copper, and is shaped like a wine-bottle. Inside is a little pillar, so placed as to move in eight directions. On the outside of the bottle are eight dragon-heads, each of which contains a ball. Underneath these heads are eight frogs, so placed that they appear to watch the dragon's face, so that they are ready to receive the ball if it should be dropped. All the arrangements which cause the pillar, when it moves, to knock the ball out of the dragon's mouth, are well hidden in the bottle. When an earthquake occurs and the bottle is shaken, the dragon instantly drops the ball, and the frog which receives it vibrates vigorously. Any one watching this instrument can easily observe earthquakes.

—Prof. T. C. Mendenhall, recently at the head of the electrical department of the signal service, has accepted the presidency of the Rose polytechnic institute at Terre Haute.

—Decatur, Ill., or rather a suburb of that town, is the latest place from which cases of food-poisoning are reported. This time it is chicken-salad which has produced the evil results. At a recent wedding-party, at which this dish formed a part of the entertainment, fifty persons were poisoned, but not fatally in any single instance. The illness is attributed to the copper from a copper kettle in which the chickens were cooked and salted.

—The J. Marion Sims memorial fund now amounts to \$7,759.91. The committee who have the fund in charge are about to take steps to erect a suitable bronze monument to the memory of the distinguished American surgeon.

—Sir Joseph Lister, the great exponent of the antiseptic treatment of wounds which is known as Listerism, has abandoned the use of the spray of carbolic acid which he formerly advocated so persistently, on the ground that his later experiments satisfy him that the germicide properties of a solution of 1 to 40 of carbolic acid thrown by a spray several feet into the air are absolutely nothing; and that the success obtained by this treatment was due to irrigation and cleanliness. He now employs sal alembroth as a dressing for wounds. This is a salt which was known to the ancient alchemists, and is a double mercurial salt formed by the sublimation of a mixture of perchloride of mercury and chloride of ammonium. Lister employs this in a solution of 1-1000, soaking in it his dressings of gauze and lint.

—The English commission for the investigation of hydrophobia is thoroughly organized and equipped for that purpose, but has as yet been unable to take any original steps in that direction, by reason of its total lack of material, no dog having become rabid since its organization.

—From the *Courier record of medicine*, we learn that a case of hydrophobia recently occurred at Fort Worth, Tex. After the child was bitten, he was taken to Fort Denton, where a mad-stone was applied, for which the parents paid twenty-five dollars. Hearing of another mad-stone, and desiring to do every thing in their power to save their child, his parents secured this one at a cost of fifty dollars, and applied it. Within a short time the child developed hydrophobia, and died.

—We regret to note the death of Prof. H. A. Bayne, Ph.D., of the Royal military college, Kingston, Ontario, Canada. Dr. Bayne was a native of Nova Scotia. After graduating in arts at Dalhousie college, Halifax, N.S., he spent five years in the special study of chemistry under Wiedemann at Leipzig, Bunsen at Heidelberg, and Dumas at Paris, and took his doctor's degree at

Heidelberg. Returning to his native land, he first engaged in organizing the scientific department of the Halifax high school, assisting the faculty of Dalhousie college at the same time to start a science course. In 1879 he was appointed professor of chemistry in the Royal military college, then just founded. Since his appointment his time has been largely occupied with the organizing of his department, and only during the last year or so has he been able to find time for original research. At the last meeting of the Royal society of Canada, of which he was a fellow, he read a valuable paper on 'Chemical tests of the purity of silk.' He had begun in Germany a series of experiments on the properties of the rarer metals, and hoped to continue them when leisure came; but with leisure has come disease and death.

—In a letter to the *Beacon*, Mr. E. B. Elliott corrects an error made in *Science* for Sept. 3. In that number, p. 219, sixth line, 287.372 should read 287.03.

LETTERS TO THE EDITOR.

*.*Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.*

A mummified frog.

Not long ago Mr. James Stevenson of the U. S. geological survey visited me for a day or two at Fort Wingate, and while here invited my attention to an interesting specimen that had fallen into his possession during a recent trip he had made in the coal-regions of northern Pennsylvania. The specimen consists of a mummified frog taken from the coal-mine of McLean county, Penn., and the following account of it is from a local newspaper loaned me by Mr. Stevenson for the present purpose. I quote the short notice in full; and the writer of it says, "One of the most curious finds unearthed lately in this region, and what may yet prove a valuable fact in the study of science and history, was singularly found by Eddie Marsh, the fourteen-year-old son of Mr. D. B. Marsh, a book-keeper for Stevenson Brothers, hardware dealers. Eddie, becoming impatient at the fire in the stove, which was not burning vigorously, took the poker and began punching it. A large lump of coal lay smouldering, and he determined to break it; and, after punching at it for a moment, the lump burst open as if by explosion, and a number of pieces flew out of the stove. One piece he caught, and he was in the act of casting it back into the stove, when its lightness attracted his attention. On viewing it, he saw that it was nothing less than a perfectly formed frog. On last evening a large number of persons viewed the little curiosity. It had been embedded in the centre of the large lump of coal, and its bed was plainly discernible when the lump was laid open. The lump of coal came from the third vein of coal in the McLean county coal-shaft, which is 541 feet under ground. The curiosity apparently was not petrified. Apparently it had been mummified instead. It was shrivelled until it is about half the size of a full-grown frog, and it is light and soft. Its shape is perfect, and the warty

protuberances of the skin are very plain. Its limbs are regular and properly shaped, including the finger-like toe of its feet, and its eyes and mouth are natural. There can be no doubt of its being a mummified frog, and now various and tough questions arise regarding it: How did it get that far under ground? How did it become embedded in that chunk of coal, which probably had been blasted from the centre of a thick vein? How many thousands of years had it been buried? and various other queries, which we will leave for the scientist to unravel and explain."

Mr. Stevenson tells me that he is personally acquainted with all the parties concerned in the discovery of this specimen, and has carefully examined the piece of coal whence the mummy was taken, and says, further, that it came from the vault, and not from either the sides or the floor of the mine.

He has done me the honor to turn the specimen over to me for diagnosis, as well as to take such steps as I saw fit to ascertain if there be any similar cases on record, and, finally, how geologists or paleontologists explain such finds as this. The specimen is now before me, and I at once recognized it as a species of *Hyla*, though I am unable to say which one. It apparently agrees in all its external characters with a specimen I have of *Hyla versicolor*, kindly diagnosed for me by Professor Cope last summer, though it is rather smaller. As will be seen



from the life-size figure I have made of it, which illustrates this letter, it is in nearly a natural position; its feet, however, are somewhat drawn up under it. I have figured it as viewed directly from above. It is completely mummified, and in a wonderfully perfect state of preservation, being of a dark, snuff-brown color, somewhat shrunken, and, in short, reduced to a condition, that, if properly excluded from the air, would keep for an indefinite length of time. I am aware that these tree-frogs very often climb into some of the most unheard-of places; but it struck me that it would be interesting to have some one tell us if they ever heard of a *Hyla* finding its way to the vault of a coal-mine 541 feet under ground, and climbing into the solid coal-bed after getting there.

R. W. SHUFELDT.

Fort Wingate, N. Mex., Sept. 14.

The source of the Mississippi.

A correspondent in the number of *Science* for Aug. 13 contributes an article on Captain Glazier's claim to have discovered the true source of the Mississippi. The writer commences by quoting *Science* of May 15,

1885, in which it is stated that Glazier gave his own name to the lake he discovered. This is an error invented by some official jealous that any man not in the employment of the government should presume to make a discovery falling within the range of the government survey. In the *Brainerd Tribune* of Aug. 14, 1881, occurs the following, from the pen of one of Captain Glazier's companions, a gentleman, it is to be presumed, of veracity. It may be premised that Brainerd is the nearest point to the source of the Mississippi that can boast of a newspaper. The writer says, after describing the ascent to the newly discovered lake through the stream that unites it with Lake Itasca, "On its one promontory our party landed after exploring its shores; and, after slaking our thirst at a spring of ice-cold water which bubbled up near by, the little party was marshalled in line, and Captain Glazier made a few remarks appropriate to the discovery of the true source of the Father of waters. After this, six volleys were fired in honor of the occasion, and then the question of a name for the new lake arose. *This being left for the captain's companions to decide*, Mr. Barrett Channing Paine, after alluding in warm terms to the time, money, and energy expended by Captain Glazier in this expedition, *proposed that it be named 'Lake Glazier'* in his honor. This proposition was received with applause, and carried by acclamation." Thus, we see, Captain Glazier did not 'give his own name' to the lake. He, on the contrary, suggested that it should retain its Indian appellation of 'Pokegama.'

There is nothing to be found in Schoolcraft's narrative to show that he penetrated south of Itasca. He speaks of an inlet to Lake Itasca leading from a smaller lake to the south, but clearly did not visit that smaller lake, and hence did not 'discover' it. Nor was it known to exist by Mr. Nicollet, who came after him. The latter explorer states that there are five creeks falling into Itasca. Captain Glazier discovered six, the sixth originating in a lake (not a lakelet) about five miles to the south of Itasca. This lake was not known to Nicollet. It lies nearly due south of the western arm of Itasca. He visited the others (which are mere ponds), but missed the most important one, probably owing to difficulty of access, the soil around it and for some distance from it being extremely swampy, and its inlet to Lake Itasca completely hidden by the densest vegetation. Such an inlet could not have been known to exist, except from the information of the Indian whose hunting-ground was in the immediate neighborhood. The 'infant Mississippi' flows from this lake, unknown until Captain Glazier forced his way into it in 1881, under the guidance of Chenowagesic. The lakelets or ponds shown on Nicollet's map have nothing to do with the source of the river; and the map itself, so far as Lake Itasca and its region are concerned, is altogether misleading. Itasca has three arms or bays, not two, as shown on Nicollet's map. The 'small lake south of and tributary to Lake Itasca' was not the lake discovered by the Glazier party; the lakes (or ponds) 'fully explored and mapped by Nicollet' did not include the Glazier Lake; and those 'surveyed, mapped, and named by the land office prior to 1879' were mere lakelets or ponds, all of them taken together considerably less in volume than the one discovered by Glazier. Your correspondent indulges in a glaring *petitio principii* in the paragraph from which the above quotations are made.

The following extract is from a letter received by the present writer in May, 1884, from Paul Beaulieu, interpreter to the White Earth Indian agency, Minnesota. Beaulieu is an intelligent half-breed, and has lived all his life within seventy miles of the head waters of the Mississippi. His letter was in answer to an inquiry as to the views of the people of that section on Captain Glazier's discovery. He writes, "I would respectfully state that, according to the ideas of the people of this section for scores of years past, in alluding to Lake Itasca, which is known only as Elk Lake, or Omushkos, by the Indians, it was never by them considered as the head or source of the Father of Running Waters, or May-see-see-be, as it is by them named. I have received a map showing the route of exploration of Captain Willard Glazier, 1881, and being well acquainted with his chief guide, Chenowagesic, who has made the section of country explored by Captain Glazier, his home for many years, and who has proved the truth of his often repeated assertion, when maps were shown him, that a smaller lake above Lake Itasca, would, in time, change the feature of those maps, and proclaim to the world that Lake Itasca cannot any longer maintain its claim as being the fountain head of Ke-chee-se-be, or Great River, which is called May-see-see-be by the Chippewas. The map as outlined by Captain Glazier's guide, Chenowagesic, and published by the Glazier party, is correct, and it is plain to us who know the lay of this whole country, (I mean by the word us, the Chippewa tribe in particular, also the recent explorers for pine,) that Lake Glazier is located at the right place, and is the last lake on the longest stream of the several rivers at the head of the great Mississippi."

Now, respecting the latitude given by Captain Glazier, it may be stated that he had with him no instrument for determining latitude; and assuming that the latitude given by Nicollet was that of the southern point of Lake Itasca, not that of Schoolcraft's Island, he did what any other person in like circumstances would have done, made as near an estimate as possible, and placed the new lake in latitude 10° to the south of that given by Nicollet.

The extracts given by your correspondent from Schoolcraft and Glazier, in parallel columns, even if they do carry some slight resemblance, have no bearing whatever upon the latter's claim to have discovered a lake which was unknown to Schoolcraft, Nicollet, or the officials of the land survey. Whatever the merits of this controversy, it is most conclusive that there is a beautiful sheet of water above and beyond Lake Itasca, which the Indians and pioneers of northern Minnesota, as well as the majority of American geographers and map-makers, now recognize as Lake Glazier, the primal reservoir of the Great River.

PEARCE GILES.

Boston, Mass., Sept. 4.

Hibernation of bats.

In a brief notice recently published in *Science* (viii. No. 187, p. 222), of a paper on the 'Migration of bats,' which I read at the Buffalo meeting of the American association, I am reported as saying that 'there is no evidence that any forms [of bats] hibernate.' Nothing in natural history is better attested than the fact of the hibernation of bats, and I hasten to correct the error made by your reporter.

C. HART MERRIAM.

An easy method of measuring the time of mental processes.

Lest it should seem that I lay claim to what is not my due, I would explain that I did not know of the exactly similar experiment of Dr. Oliver Wendell Holmes with a circle of people, until Professor Bowditch called my attention to it at the recent meeting of the American association. At that time the paper printed in *Science* had left my hands. I hasten to yield any claims to priority for this method of measuring simple reaction times for the privilege of having so distinguished an anticipator as Dr. Holmes.

I must thank Professor Mendenhall for the reference to his interesting article. I find, however, that his very ingenious method resembles the usual laboratory methods much more than it does mine.

JOSEPH JASTROW.

Germantown, Sept. 19.

The law of volumes in chemistry.

In my letter with the above title in *Science* for Sept. 10, there occurs an obvious error, since $1,628 \times 18 = 29,304$, and not 30,304. The slip of the pen was the more curious from the fact that the correct figures were already printed in my yet unpublished volume, 'Mineral physiology and physiography.' The above coefficient for the formula of water is calculated from the datum in Ganot's 'Elements de physique,' that the relation between the volumes of water at 0° and vapor at 100° = 1:1,698. I hope to discuss at length the questions raised in my late letter before the National academy of sciences at its meeting in November.

T. STERRY HUNT.

Montreal, Sept. 17.

Cause of a recent period of cool weather in New England.

In a recent issue (*Science*, viii. p. 233) I called attention to a period of cool weather which prevailed in New England from Aug. 15 to Aug. 23, culminating on the night of Aug. 22; on which night, I now learn, frosts were observed in the lowlands near Boston.

I now desire to call attention to another aspect of this phenomenon; namely, that, while this abnormal cold prevailed at the earth's surface, at a not very great altitude above the earth's surface the temperature was above the normal, and increased during the night. At the top of Mount Washington the temperature was several degrees above the normal, and was slightly higher at the morning observation of the 23d than on the previous evening; but an absence of self-recording instruments prevents a more extended study of the phenomenon. This want was, however, supplied at Blue Hill, where a Richard thermograph at the top showed an almost continuous rise of temperature after the 11 P.M. observation of the 22d, until after noon of the 23d; while a Draper thermograph at the base of the hill, 400 feet lower, showed that the temperature fell almost continuously until 5 A.M. (about sunrise) of the 23d, at which time the temperature was more than ten degrees lower at the base than at the summit. Both thermographs showed short undulations common to thermograph curves. This fall in temperature during the night, no doubt, also occurred at the Boston signal office, since the temperature observed at 3 A.M. of the 23d was four degrees lower than at 11 P.M. of the 22d. The close coincidences between the readings of the self-record-

ing minimum thermometer at the base of Blue Hill and at several surrounding stations seems to show that the phenomenon recorded at the base fairly represents what occurred over the whole of the surrounding country. A minimum thermometer observed by Rev. A. K. Teele of Milton, about two miles north of Blue Hill, gave a temperature of 41° ; and one observed by Dr. Granger at Randolph, five miles south-east of Blue Hill, gave a temperature of 44° , — the same as that observed at the base of Blue Hill.

These observations show very clearly the gradual increase of temperature with height above the earth's surface: 1° , at the earth's surface in low places, the temperature fell to or below 32° F., as shown by the formation of frost; 2° , at the height of a few feet above the surface, the temperature fell to not quite 40° ; 3° , at a height of 156 feet above ground, the temperature only fell to 49° , as shown by the records of the Boston signal office; and, 4° , at a height of 650 feet above sea level, and more than 400 feet above the surrounding land, the temperature only fell to 50.5° , as shown by the records at Blue Hill observatory.

I pointed out in my last letter that on the night of

The two species of *Solenodon*, *S. cubanus* and *S. paradoxus*, are indigenous respectively to Cuba and Hayti. Of the latter species almost nothing is known. The specimens of the Cuban species recently received were obtained by John Gundlach, Esq., in the interior of the Sierra Maestra, some thirty miles from Bayamo. He writes to Professor Baird regarding them as follows: "A friend, who has sent all the *Solenodons* to Professor Poey and myself, has, after the promise of many years, received a pair of living *S. cubanus*, captured in the high mountains thirty miles from Bayamo. This animal is very rare, and difficult of obtaining, because he lives in caves which in most cases pass under great trees, and cannot therefore be penetrated into."

The female and young individual died on the way, but the male arrived in excellent condition. Though in reality a nocturnal animal, he shows no dislike of sunlight. He has been fed on small pieces of raw beef, of which he seems very fond. Some of his attitudes are quite singular: when inspecting the floor of his cage, he rests the weight of his body on his hind-legs, while the front feet barely touch the floor;



THE ALMIQUL.

Aug. 22 the sky was clear, and that the air was very dry, and must have descended from above over New England, since the surface-wind blew out from this region in every direction; and the facts just given seem to clearly indicate two opposing actions on the air: 1° , a heating effect, due to compression of the air by its descent; and, 2° , a cooling effect, due to radiation, chiefly from the earth's surface. At elevated points, such as Mount Washington, where the land surface is very small, the heating effect was in the ascendancy; the temperature of the air was above the normal, and actually increased during the night. At lower stations the cooling from radiation was in the ascendancy, and the temperature of the air fell continuously during the night.

H. HELM CLAYTON.

Blue Hill meteor. observ., Sept. 10.

The Almiqul.

The Smithsonian institution has recently received a living Almiqul, *Solenodon cubanus*, one of the rarest of American mammals, and the largest of American insectivores. Three individuals were captured, but only one survived.

when his attention is attracted, he raises his long, flexible snout, and advances the abundant vibrissae so that they stand at right angles with the head. Ordinarily the vibrissae lie back against the cheeks.

The specimen measures about eleven inches, exclusive of the tail, which is seven and one-half inches long. He will be sent to the Philadelphia zoölogical gardens.

F. W. TRUE.

U. S. nat. mus., Sept. 13.

Revivification.

Your correspondent V. in *Science*, No. 187, inquires concerning the fakirs of India, and the wonders of their voluntary suspension of vitality. He will find the information of which he is in search very fully given — more fully than at any other place of which I am aware — in a small volume published in 1850 in London. Its title is 'Observations on trance or human hibernation,' by James Braid, M.R.C.S.E., C.M.W.S., etc. (London, John Churchill, Princes Street, Soho; Adam and Charles Black, Edinburgh). Both the facts and the proofs are very clearly set forth.

W. O. AYRES.

New Haven, Conn., Sept. 13.

SCIENCE.—SUPPLEMENT.

FRIDAY, SEPTEMBER 24, 1886.

THE SOCIAL WASTE OF A GREAT CITY.

In the human body there is a legitimate waste of tissue and substance, structurally indispensable to its best development ; and there is waste which depletes vitality, and is beyond the power of science to make good, while it is the herald of approaching dissolution. A great city is a corporation, a body politic. This complex organization, too, has a legitimate waste as a perpetual evidence of its thrifty increase ; and at the same time it suffers waste which is dead loss of social capital and resource, while it points the way to ultimate disintegrations. Men and cities thrive, waste, and perish on parallel and strictly analogous lines. During a professional service of ten years among the charitable institutions under the control of the Board of commissioners of charities and correction, and also under the commissioners of emigration, this fundamental maxim of social science has gathered significance with the growth of experience. The people have become so accustomed to this downward drift, — this unresting current of wretchedness, profligacy, and crime, — possibly so hoodwinked by the imposing array of architectural groups, and the glamour of official reports bristling with statistics, that they miss the ghastliness of the situation, and think about it, if at all, in a vague and unconcerned way. But to the earnest observer, ghosts constantly arise which will not down. There is much ado in commercial circles about the *débris* and material waste of the streets and houses, and its best disposition ; the people knowing full well that pestilence and epidemics bear with no trifling or superficial expedients. Besides, the harbor and its approaches must be neither choked nor befouled. The fear of disease, the dread of death, the timidity and greed of capital, keep sharp and suspicious watch, and in this direction the public welfare is measurably safe.

But outside a group of philanthropists and professional people, whose lives are spent in the service of this great and growing under-world of poverty (breeding desperation) and vice (breeding both poverty and crime), few care or think about it, or undertake to penetrate its dreadful secrets ; while the casual shoaling of the harbor-channels, the grounding of an ocean-going steamer, the least chill or check of financial thrift, a trace of typhoid or small-pox, the transportation of dressed beef or

cattle, the tug and chicanery of rival monopolies, the disgusting encounters of professional pugilists, stir and thrill the pulses of the metropolis to their liveliest beat.

All the while, this menacing under-world, with a biting irony, asserts itself, and compels recognition as imperatively as does the cancer as it eats its way to the vitals. It seizes upon and subsidizes the fairest string of islands that grace a metropolis the world over. Where there might have been, under a shrewder, better providence, parks, groves, museums, art-galleries, zoölogical gardens, wholesome games, exhilarants for honest industry and useful thrift, stretching at little intervals from Governor's to Hart's Island, full eighteen miles, the Nemesis of penalty and retribution has planted her growing colonies of social waste, — of broken, degraded, repulsive, dangerous human detritus ; and this baleful colonization has pushed its way along those beautiful eastern waters, keeping step with the advancing city, until its entire line of eastern frontage, far up into Westchester county, is sentinelled by these menacing excrescences of a moribund civilization. The municipality is a body ; and it requires no labored or exhaustive differential diagnosis to determine that a body thus smitten with boils and blains, with tangled and distempered wits, so scorched with fevers of drunkenness and debauchery, so threatened with poison in the very life-blood, is at best in a desperate condition.

So much for these 'institutions of charities and corrections.' In abundant outlay and thorough and intelligent organization, and in general scientific oversight, they stand, after their class, unrivalled, at home or abroad. Indeed, we have come to make much of them ; so that when distinguished visitors, dignitaries, or scientists come upon us for municipal hospitalities, who does not forecast the inevitable festive picnic excursions through and among these same 'institutions,' with its steamer decked in bunting, its junketings, its congratulatory speeches, as the commissioners uncover our plague-spots and social ulcers, our paupers and desperadoes, our crazed, and our foundlings, for the edification of the day ? Why not extend the route on future occasions, and so complete the panorama ? This would take in the morgue and Potter's field, and their upland springs and feeders ; the bagnios, with their more than fifteen thousand profligate women ; the ten thousand dram-shops ; the underground hells and disreputable

concert dance-halls, which day and night, year in and year out, keep up the infernal work of peopling these islands. There would be something like logic and thoroughness in such an exposition.

The extent and magnitude of this social waste no man knows, and no man can know. There are outlying hidden realms of developing, maturing mischief and evil yet in the egg, scattered, unsuspected items of blemish and loss, which no report ever tabulates; and we are thrown back upon the depressing consciousness that the larger part of this under-world, like the freighted steamer or the floating iceberg, lies well out of sight.

Let us take a rapid account of stock, and, in part at least, see where we stand. First these islands: Blackwell's, nearly two miles long, flushed by two swift channels of the river it divides, full ninety acres in extent, studded from end to end with the epileptic and paralytic, maternity, and charity hospitals, the New York penitentiary sprawling athwart well-nigh from shore to shore, the almshouse, the workhouse, and the women's lunatic-asylum and its growing population of more than seven thousand; then Ward's Island, lying in a nearly rectangular area of two hundred and sixty acres, at the junction of the Harlem and East rivers at Hell Gate. Here are the lunatic-asylum for males and the homoeopathic hospital, together having about three thousand inmates. Immediately north, and separated by Little Hell Gate, some two hundred feet wide, is Randall's Island, a shield-shaped area of a hundred and sixty acres, and, with Ward's, lying close to the city. Here are the infants and Randall's Island hospitals, an asylum for idiots, a branch of the penitentiary, an insane-asylum for the young, and the house of refuge. Advancing a mile, we find Riker's Island, for the exclusive use of correctional institutions, a fair domain of sixty acres; and yet farther up the sound, some seventeen miles from the city, the advanced post of this ever-growing colonization, with its area of some fifty acres, its hospital for incurables, and branch workhouse and lunatic-asylum (nearly thirty-five hundred inmates), and—the ghastly halting-place of all this interminable procession—Potter's field, with its myriads of friendless, dishonored dead: we reach and stop at Hart's Island.

Here are more than six hundred acres of the fairest islands lying all the way close to the city frontage, now become a rank witness of its loss and shame. Who will venture an estimate of the present and prospective value of this perverted, sequestered real estate, and the outlay represented in its multiplied structures? Add to these assets of the Board of commissioners of charities and corrections a fleet of transports for the service of

more than sixteen thousand colonists, Bellevue hospital, the various buildings in the service of the department, the hospital service at police stations, ambulances, equipments, prison vans, then the police stations and properties, the jails and prisons, and a just allotment of court and justice chambers, where the selections are made and the harvest of tares gathered,—this is but a fraction of cost and loss to the people,—a shameful investment, which, as will shortly appear, feeds the sources and energies that exact it.

We must not lose sight of the millions spent in the erection and support of foundling-asylums, reformatories of various sorts and uses, dispensaries, children's aid societies, infirmaries, and hospitals founded and sustained by individual and private beneficence,—all part of the great total exactions wrung from the public thrift, and turned aside from legitimate uses and benefits to the nourishment and maintenance of this terrible under-world.

It is equally impossible to measure the yearly outlay in this account with social waste. The board of commissioners alone send in estimates for their own disbursements for 1886, amounting to \$1,947,607.50. According to the city comptroller's report for 1883, the appropriations for asylums, reformatories, and charitable institutions, presumably outside such as are committed to the care of the commissioners of charities and corrections, was \$1,029,953.53, and this had in 1885 grown to \$1,108,957.51. This total ratio of growth in the increasing cost of social waste must not be lost sight of, for the colonies grow by a visibly advancing ratio: so does the cost in all the municipal departments having special care of them; while the conservative reparative institutions lag behind the constantly increasing development of the city. The Board of education, for example, for ten years past, scarcely breaks the even tenor of an annual appropriation, which fell to \$3,400,000 in 1879, and rose to \$3,769,086 in 1874, and only reached \$3,750,000 in 1883. These data are drawn from the comptroller's report of 1883. Later accounts might throw light upon this apparent decline in the educational enterprise of the city. In this hurried glance at the schedule of assets, we are not to lose sight of the police department,—a standing army, keeping guard night and day, trained, officered, armed, and paid,—the picked brawn and muscle of the town, banded together for the public protection. Add to these another army of keepers, attendants, nurses, deputies, resident bodies of medical men and their student assistants, and we begin to catch an outline of the magnitude and proportions of outlay in money, values, time, and men, sub-

tracted from the normal uses and functions of thrift-production both in social and civil life, both of which are thus far impoverished and debilitated because of this shrinkage and loss in vitality. Here the sociologist is baffled; for no statistical tabulation, however minute and exact, adequately or even approximately represents the substance of the problem.

I do not review the physical elements of this problem to arraign the authorities, or to challenge the costliness of the attempt to meet and discharge an absolute duty: it is simply the exaction of Nemesis, — the price of ignorance, unthrift, sensuality, and crime, which the people must pay in one shape or another. The questions left for consideration are the sources of social waste, and the practical hinderances in the way of their municipal relief and correction.

The sources mostly lie far back out of sight, and in unexpected places. Among these is the pressure of labor, especially women's labor; and the tens of thousands of young girls literally imprisoned over-hours at the sewing-machine, behind the counters of stifling shops, in cigar-factories and at tenement-house tobacco-work, in factories innumerable, where the fever of competition feeds on the blood and brain of girls and children, with the inevitable poisoned air, insufficient nutrition, and exhaustive toil, constitute one of the most perilous sources of supply for the vicious and criminal classes. Hunger, desperation, unendurable tension of nerve and muscle, are all the time goading thousands toward mercenary profligacy. These conditions are not only unfriendly to virtue and chastity: they create and intensify those critical conditions that breed shame and dishonor. Virtuous, easy-going ladies and gentlemen must get their haberdashery at bargain prices, even at the yearly immolation of hecatombs of girl and women workers who are literally starved into the ranks of the falling and fallen. Among all the thousands who drift into the island population, there are found few exceptions to this experience. Poverty, lust, and drink, — these three, — and their progeny, profligacy and crime, cover nine-tenths of the social and moral history of these coming and going islanders. The disreputable dance-halls and concert dives and bagnios, and vile places of resort of one kind and another, all connect with this range of hopeless, suffering world of women-workers.

When capital and commerce grow humane, and become as considerate of human hearts and lives as they are of machinery, vehicles, horses, and other useful appliances of industry and honest increase, then, and not sooner, will this diabolic waste of womanhood be checked and stayed.

Note again the viperous nests of friendless and orphaned boys and lads who herd in out-of-the-way covers in or about the city, without homes, teaching, or training; the progeny of criminals, or paupers, or drunkards; getting keenness and animal ferocity out of their hardships, and a training, of its kind, for the full-grown thief, burglar, and murderer.

Mr. Delamater of the New York police department, after careful estimate, states "that seventy-five per cent of our convicts are city born and bred," and adds, "that, of the 2,576 inmates of the three state prisons of New York on Sept. 30, 1884, 1,645, or 63.8 per cent, were from Kings and New York counties."

The secretary of the National prison association writes more conjecturally but more emphatically: "I looked over . . . my list of cases which I have investigated personally, and find that more than four-fifths of the wrong-doers were either born in cities, or had become residents of cities when very young. . . . If you had asked 'as between large towns and city, and country bred children,' I should have been obliged to add almost the other fifth."

"The celebrated French reformatory, Mettrai, has since its foundation admitted 3,580 youthful inmates: 707 of these were the children of convicts; 534, 'natural' children; 221, foundlings; 504, children of a second marriage; 308, those whose parents live in concubinage; and 1,542, children without either father or mother" (*Une visite à Mettrai*, Paris, 1868).

"According to Dr. Bittinger (Transactions of the national congress, p. 279), of the 7,963 inmates of the reformatories of the United States in 1870, fifty-five per cent were orphans or half-orphans."

M. de Marsaugy, a clever French author, in writing of the causes of juvenile crime in France, says that "a fifth of those who have been the objects of judicial pursuit are composed of orphans, the half have no father, a quarter no mother, and, as for those who have a family, nearly all are dragged by it into evil" (*Moralisation de l'enfance coupable*, p. 13).

The precocity of the criminal classes is notorious and portentous. It sets back year by year, until the courts have long since passed the teens, and children under twelve are seen in the prisoner's dock with growing frequency, for serious misdemeanors and crimes. The police confess the practical difficulty, not so much of exterminating, as of repressing, these nests of juvenile outcasts, who prove more formidable, even, than bands of adult outlaws. Something is done towards depleting this threatening element, under the action of the Children's aid society and the various half-penal reformatories. But these latter too often

send out graduates, ripe in the vilest lore of evil, contracted while under the costly care and training of the state.

Superintendent Kellogg of The charity organization society, in an address before the American association of social science, 1886, states :—

"In 1883 every twelfth commitment by the courts of New York was either of a girl under twenty, or of a boy under fourteen years of age : of the former there were 2,054, and of the latter, 2,118, a total of 4,172. At the same time there were thousands of children drawn from the poor, permanently lodged in the public correctional institutions and the fifteen or twenty reformatories of the city. Those youth who have fallen into police custody are probably lost for any good purpose to the community ; and that loss, it will be seen, is greater pecuniarily and numerically than that caused by preventable death. As a social disease, their presence in the community is injurious beyond computation, since an infiltration goes on from them through gradually enlarging areas of society. Nor is their depravity like the calamity that comes with a blow, and then all is over. Having reached adolescence, they go on from year to year, dependent, predatory, contaminating."

We have taken too superficial an estimate of the tramp population in its relation to social waste and disorder.

The following statistics were taken from the Annual report of the Board of police justices of the city of New York, for 1884 : "6,275 persons were arrested, or appeared in the police courts of New York City, in 1884, against whom a charge of vagrancy was preferred ; and of this number, 5,892 were convicted upon competent testimony or upon their own confession."

Comparison with former years.

YEAR.	NUMBER ARRAIGNED.			NUMBER CONVICTED.		
	Males.	Females.	Total.	Males.	Females.	Total.
1874	1,751	1,388	3,139	1,572	1,293	2,865
1883	3,012	2,566	5,578	2,737	2,434	5,171
1884	3,638	2,637	6,275	3,372	2,520	5,892

"The number of persons arrested upon the charge of disorderly conduct in 1884 was 28,696. Of these, there were convicted and fined, or held to bail for good behavior, 20,311."

Comparison with former years.

YEAR.	NUMBER ARRAIGNED.			NUMBER CONVICTED.		
	Males.	Females.	Total.	Males.	Females.	Total.
1874	13,568	7,125	20,693	7,058	4,699	11,757
1883	16,272	7,611	23,883	10,517	6,196	16,713
1884	19,944	8,752	28,696	13,141	7,170	20,311

"The registration bureau of The charity organization society of New York City records a list of 71,332 different families, or a total population of 285,000 individuals, involved in mendicancy or dependence" (*Report of Charity organization society*, 1886).

This waste shows a deadly apathy, a dying-out of purpose, a fatal estrangement from home, family, and society, for which there has, as yet, been found neither remedy nor cure. This tramp class grows, and grows dangerous and desperate too, and is chargeable with an increasing number of outrages, assaults, and crimes against both property and person. The island, the almshouse, and workhouses do not reach or touch their cases, for they gather physical endurance and resources from fresh campaignings across country, until rounded up again by winter weather in the great cities. Even the dead weight of this class, like sheer moral inertia, rests like an incubus upon the community ; a species of leprosy, in short, that spreads while it kills, surely if slowly. This discouraged, cowed, broken-down class is likely to increase, under a civilization which develops millionnaires and monopolies out of the feebleness and misfortunes of the masses. Strange illustrations of this soulless work of disintegration may be found any and every day in hospital, penitentiary, almshouse, insane-asylum, or morgue.

But well-to-do labor, legitimate, hopeful industry, insensibly contribute their quota in the multitudes, who, too heavily handicapped in the struggles, in the irresistible spirit of emulation and haste for riches that stimulates and fires on all sides, succumb to some form of mania or insanity. The inmates of these insane-asylums are largely overworked, over-anxious lives, thrown out of gearing often by a very slight obstruction,—lives too far collapsed to resist an appetite or passion which might hardly ruffle the equipoise of a robust nature.

The heredity of evil is an element of incalculable significance, the fearful rolling-up or rolling-down from generation to generation, through all the ages, of the weakness, vice, and moral darkness of the past. The increase is more than compounded. It spreads and penetrates in every direction without spending or diluting its death-dealing vigor. Evil is gregarious, it is prolific. It grows into a society of its own, well named the half or under world. It stamps its offspring indelibly. It not only inbreeds to deadlier purpose : it grows by what it captures, defiles, and anneals in some vital, hopeless way to itself. No man or woman who is 'sent up' to these colonies ever returns to the city scot-free. There is a lien, visible or hidden, upon his or her present or

future, which too often proves stronger than the best purposes and fairest opportunities of social rehabilitation. The under-world, with the police and detective forces practically in its interest, holds in rigorous bondage every unfortunate or miscreant who has once 'served time.' There is often tragic interest in the struggles of these ensnared wretches to break away from the meshes spun about them. But the maelstrom has no bowels of mercy; and the would-be fugitives are flung back again and again into the devouring whirlpool of crime and poverty, until the end is reached on the dissecting-table or in Potter's field. Men who insist on breaking with this tyrannous fellowship are often driven to seek refuge among the various institutions on the islands in menial or half-menial service as helpers, messengers, or orderlies, under the beggerly wages of the department, as a better alternative than a life at large, constantly imperilled by the threats and allurements of evil association.

A serious percentage of this waste is thrown at our doors by emigration. "Less than forty-eight per cent of the criminals convicted in the police courts of the city of New York in 1884 were native born. Of the total number, 51,845, the United States contributed 24,511; Ireland, 16,349; Germany, 5,272; England, 1,801; Italy, 1,707; other countries, 2,205" (*Annual report of Board of police justices*, New York, 1884). Thus, while it is not properly our own, we become charged with its care and cost. Many of the old abuses have given way before a more intelligent and discriminating legislation; and the penitentiaries, workhouses, and almshouses of Europe no longer engage in the systematic and wholesale deportation of their paupers and criminals to our shores. But in the large volume of a growing and desirable immigration, the casualties and exhaustion of ocean travel, epidemics, and misfortune, leave many stranded and helpless in this great city.

But the crowning, almost inclusive source of public injury is unquestionably strong drink and drunkenness. Yet the people pocket a hush or conscience money of half a million or so yearly, and then legalize or explicitly connive at the establishment of more than ten thousand drinking-places in the city. The moralist and social reformer have for generations shouted in our ears and spread before our eyes the terrible statistics of this most inhumane and inhuman traffic. Judges from the bench take up and repeat the refrain. Science and philanthropy, hand in hand, demonstrate, expostulate, and threaten; yet the bribe-taking goes on, and the city, for its yearly dole of half a million, lets loose this army of incendiaries, more dreadful than conflagrations,

more deadly than pestilence, more destructive than the field of battle. It is no metaphor to attribute this moribund, hopeless, repulsive, excrescence population to the parentage of strong drink; for drink and debauchery are inseparable, and poverty and crime and pestilence are their progeny. If drink and lust furnish three-fourths of the criminals, they are more lavish yet with the almshouse, and they have a busy hand in filling the wards of the hospitals. Eliminate or shorten within hygienic limits the traffic in strong drink, and these institutions of waste would in a decade shrivel and shrink well-nigh out of sight.

What can the moralist or scientist do by way of resuscitation? Very little at best. The flotsam and jetsam are mere shreds and fragments of wasted lives. Such a ministry must begin at the sources, — is necessarily prophylactic, nutritive, educational. On these islands there are no flexible twigs, only gnarled, blasted, blighted trunks, insensible to moral or social influences.

The physician, priest, and turnkey share a common outlook of nearly baffled hopelessness; and almost the sole blossom — the sole fair and precious jewel to be found in this world of refuse and desolation — is the culture of a stronger, surer medical science, and the training and education of ministrants for the sick-room and hospital wards. And the sole ground of hope and amelioration lies in the rigid enforcement of a more practical civil service, and in the vigilant, gratuitous, and inexpensive supervision of the State board of charities, whose stated and fearless probings into dark, unsuspected corners, whose scientific insight and humane devotion to their unwelcome mission, have instituted or energized every project or reform for betterment thus far attempted in our municipal institutions.

The hinderances in the work, and the conditions unfavorable and even hostile to its best administration, lie in full sight of every thinking observer.

First, we note the illogical and most unrighteous affiliation between crime and poverty. 'Charities' and 'corrections,' forsooth, some diabolic Malaprop surely linked these terms in unequal fellowship. What have criminals to do with the sick and poor, and why should conditions morally more widely separated than the poles be literally handcuffed in mutual ignominy? The relation between crime and poverty is no more essential than between crime and wealth. It is not for a so-called modern civilization to smirch and befoul a condition in life in itself honorable, reputable, and of a certain dignity, by involuntary association with the tramp, harlot, thief, and assassin. There is a charity called for at the hands of the municipality which suffers unendurable shame and affront

under this duplex administration of charity and correction. There is much pitiable, unfortunate, blameless poverty finding shelter in the hospitals and at the almshouse. Why should it be thrust into intolerable contrast with shameful, dissolute pauperdom? Keep the abused term 'pauper,' if it must be, to mark the latter herd; but leave 'poverty' and 'the poor' to the patient, long-enduring, suffering, and often heroic victims of failures, that fall under the wheels of success or monopoly. To such, a true life pays involuntary courtesy as to the maimed, unshapely, helpless victims of the battle-field. Because of this graceless confusion and breach of duty, much that even municipal charities might undertake and accomplish is now hopelessly out of reach.

The conclusion is irresistible that a fatality lurks in the very organization of the board of management. Here is the sphere where there is a demand for the soundest philanthropist, the matured student in sociology, together with the bravest and wisest medical service. Such alone are competent to look after and administer this settlement of social waste. There is natural congruity in this postulate. Financiers, we say, for banking, trust funds, and the public treasury; metallurgists and chemists and engineers, for mining; learning, logic, and eloquence, for the forum: that is, the specialist full ripe for his specialty. But how is it with this board who have so long been in place? Here and there the tonic presence of a strong personality has been felt; but who is so weak or stupid as to identify the board, under its present constitution, with these necessary interests in the life of the community?

And here we are forcibly confronted with a monstrous anomaly, and it is the constant peril of this whole field of municipal administration. The Board of commissioners of charities and corrections, together with its entire system from greatest to least, from centre to outpost, is in abject slavery to municipal politics, is a recognized, hopeless appendage of the 'machine.' It does not spring frankly and wisely from the popular suffrage. It has no freedom, no will, no autonomy. On the contrary, it is honeycombed with bureaucracy and officialism; and the powers that move and manipulate every member of this great constituency are as far removed above their heads as the chess-player above the pieces he manipulates. This is the inherent vice of a system which relegates the administration of the under-world of social waste to the machine and its politicians: for at the outset a vicious circle is established. The dram-shops are the spawning-grounds of municipal politics and politicians. Yet these same dram-shops are chiefly responsible for the existence and growth of

the very institutions over whose fortunes the politicians, their other progeny, have come to preside. What else could happen than has steadily happened, — perpetual jostlings, abuse of discipline, tampering with the courts, muddling of justice, and an impassable chasm which separates between a time-serving officialism and the scientific and professional superintendencies, — a deadlock which discourages, if it does not paralyze, the *esprit de corps* of medical administration; which withholds the incentive for legitimate emulation, and reduces the men who devote, and not unfrequently surrender, their lives to the standing of tide-waiters under the bidding of an irresponsible board, which is itself nothing better than an accident in political evolution? The machine is supreme; and the commissioners rattle their own handcuffs of partisan servitude while reducing this array of employees and subordinates to the lock-step of partisan bondage. The same process is going on in the kindred departments of municipal administration, as the Department of public works, the Fire department, and the Board of education. Pickings and stealings, the building-up of snug fortunes, the judicious nursing of thrifty opportunities, are insignificant elements, if they really lie in the subject. The crowning injustice, the superlative cruelty, lies in the fact that this gravest trust from the people is become at once the toy and makeshift of professional politicians.

When the Board of commissioners of charities and corrections shall come to be made up of philanthropists, men versed in sociology, who accept a duty toward the people as the highest and most inviolable of trusts, instead of men who regard public office as personal property; men who live above all entanglements of political chicanery, — then there will be found ways for checking and lessening this current of social waste, even if it may never be absolutely arrested, and moral disinfectants, detergent and tonic energies, be brought to bear directly and hopefully upon these imperilled thousands.

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FROM THE THIRD TO THE SEVENTH YEAR OF CHILDHOOD.

M. PEREZ, in the present volume, continues his study of 'The first three years of childhood,' which has been made familiar to English readers by the translation under the direction of Mr. Sully. Our author thinks that these four years form a distinct period in child-development, — more so, at any

L'enfant de trois à sept ans. Par BERNARD PEREZ. Paris, Baillière, 1886. 8°.

rate, than that from the third to the sixth or the eighth year, — and is ready to employ the same psychological method of observation in this study as in the former one. The task is more difficult as the subject is more complex. Apart from the author's rather characteristic French diffuseness, the work bears the evidence of its being the first attempt to write the psychology of this period of childhood. As the book is addressed to a rather popular audience, the diffuseness is not so serious a fault as it would be if the subject were capable of that scientific treatment which is as yet only an ideal. One who appreciates the difficulty of the task will be lenient towards the defects due to the newness of the subject. It is perhaps rather an unfortunate period for writing the book: the evidences are abundant that in ten or fifteen years it will be possible to write a better and more scientific work. Great credit is due M. Perez for venturing into this new field.

At the very outset an important point is touched upon. As we pass from infancy to childhood, it becomes less possible to make precise statements. Children under three years will differ considerably in the development of their powers; but these differences are insignificant, compared to those between various children of six or of seven years of age. Here, again, that suggestive analogy between the infancy of the individual and the race seems to hold: savages, like young children, have no real geniuses.

This important fact at once changes the method of study. For some problems, statistics should be called upon, for which kindergartens and schools should be ready to furnish the material.¹ This part of the subject, M. Perez has almost entirely neglected. Where this method is inapplicable, one is thrown upon the insight and psychological tact of the observer, — a faculty closely allied to the insight into human nature attributed to novelists and dramatists. It is a quality of mind more feminine than masculine (witness George Eliot); and thus, while the father is better suited to study the psychic activity of the first three years, — requiring, as it does, an unprejudiced, matter-of-fact observer, — the mother's tact will do better with the next four years.

M. Perez has little to say of the physical development of this period, but confines his attention to the higher psychical processes, such as memory, association, imagination, abstraction, inference, emotions, will. He prefaces the discussion of each with the current psychological views upon the topic, and then treats of its place in the child's

mind. Many interesting points are touched upon, a few of which may be here noticed.

At the end of the third year, no remembrance of the first two years remains: the child can with difficulty recognize objects after an eight or ten months' absence. In some cases the environment of the second year, though forgotten at the age of four, is recalled at the age of six. Apparently, the growth in the brain has made the impression more easily revivable. But the mere retentive power is strongly active, and, according to Bain, is at its maximum between the sixth and the twelfth years. This is the period the educator uses to store the mind with raw materials, the multiplication-tables, and so on. M. Perez found, that of a class of children six to seven years of age, asked to repeat a short passage after three hours' interval, only a very few could do so correctly, while two-thirds made from three to six mistakes. At the age of ten, the mere tenacity of memory has reached its height, the best memories have come to the front, and special aptitudes of memory begin to show themselves.

M. Perez is quite warm in his advocacy of the naturally optimistic bent of childhood. He regards physiological temperament as an important factor in one's philosophic views; holds that children fed on milk and fruit have a calm and sweet imagination, while those who over-indulge in meats, spices, and sugar are ardent and capricious; and thinks that the pipe, beer, and meat diet have much to do with the German form of that 'aristocratic neurosis,' pessimism. A well-fed, healthy child, whose temperament is naturally sanguine and nervous, with a touch of the lymphatic, whose circulation is quick, whose functions are constantly growing and adapting themselves to their environment (which, according to recent theories, is the definition of pleasure), is on a good path to optimism. The rôle of pain as an educator leaves the stage early: life doubtless begins with much pain; but, as soon as the habit of growth has well set in, the whole life of children is pleasure-giving, with a savage-like indifference to pain. Childish improvidence, and shortness of memory, reduce moral pains to a minimum. His imaginary troubles (so essential a part of our own troubles) are few and distant. Childhood is selfish and happy.

A German writer has written a pamphlet on the 'Lies of children.' The word must be understood in a wider than the usual sense. The distinction between the actual and the imaginary, the objective and the subjective, is not as sharp and clear to children as to us. Their world is more akin to that of the poets, where it is allowable to idealize common facts, and spice the truth with a pinch of fiction. A child of six will often tell an un-

¹ For an example of such a study, see 'The contents of children's minds,' by G. Stanley Hall, in *Princeton review*, May, 1883.

truth knowingly to get out of scrapes, to shift the blame on others, to arouse a laugh and thus change the subject, and do it with great logical acuteness. An emotional element often enters; fright makes them unable to clearly tell what has happened; distrust of adults often acts in the same way. One must gain the child's confidence to be able to correct the fault. It is only under bad treatment or hereditary taint that the habit becomes a serious moral fault: in its typical phase it is simply a stage in the intellectual development of the child.

The dawn of self-consciousness is an interesting stage in child-growth. This M. Perez very justly divides into two parts: the first is the age at which the child distinguishes its person as a thing apart from other external things, and which M. Perez puts at ten months, although Preyer's child, more than one year old, caught hold of its arm as an external object; the second, the age at which it recognizes itself as the centre of the emotions, thoughts in which it lives. This is not clearly done until the age of five or six: at about that age the child has ample material for taking the introspective attitude, and studying his own personality. Lotze, it may be noted, considered the attention to one's self which a new dress causes, as an important agent in the development of self-consciousness.

The logic used by children is an interesting topic. The unconscious processes of thought must be included under this term. When the child says it avoids the fire because it burns, it goes through an unconscious syllogistic process. But, having little knowledge of general propositions, its deductive processes are very rudimentary. The induction has the same faults as that of hasty reasoners,—generalization on too slim a basis. If the uniformity of nature is the guiding principle of induction, evidently one who has had little experience of this uniformity will go astray in his logic. Little Jack concludes that men do not go to church because his father does not.

The emotions of the first years are vivid, transient, and *naïve*. The child's actions are largely impulsive: it has no reasoned moral algebra. It has a meagre conception of time: it lives in the present, and future ills have little meaning. A child usually overrates its own powers, is sanguine and selfish. The higher sentiments, aesthetic and moral, depend largely on education.

The development of the will includes a motor, an intellectual and an emotional element. With the development of the muscular system, its acts come to coincide more and more with its intentions. The repressing of unnecessary, partly reflex manifestations is one of the most

serious tasks of childhood. It requires all the skill of the parent and educator to make the child a useful, mentally economical member of society, without killing out that *naïveté* and naturalness of development so difficult to retain amid the artificiality of modern society. It is here that the formation of habit as a saver of time and energy becomes all-important.

Perhaps this sampling sufficiently indicates the contents of the work of M. Perez. It opens a rich field. Those who come after will be glad to profit by his experience. JOSEPH JASTROW.

WORK OF THE MAINE AGRICULTURAL EXPERIMENT-STATION.

THIS modest report of eighty-seven pages covers the work of the station from its foundation, July 1, 1885, to June 30, 1886, and, though small, is a model of what such reports should be. The first portion is devoted to the fertilizer control work, and contains analyses of seventy-five samples of fertilizers and fertilizing materials, together with explanations of the principles on which the 'valuation' of fertilizers is based.

The second portion of the report is of more general interest, and contains the results of several feeding experiments. Determinations of the digestibility of indian-corn, corn-meal, and corn ground with the cob, when fed to a pig, showed that the meal was much more completely digested than the whole corn, while the percentage digestibility of the corn-and-cob meal was below that of the whole corn. A computation based on the proportion of corn to cob in the corn used showed, that, if we assume the corn of the corn-and-cob meal to have had the same digestibility as the whole corn, about one-ninth of the cob was digested.

Some experiments on milk-production showed a decided gain to result from substituting cottonseed-meal for a portion of the corn-meal of a ration consisting of hay and corn-meal. Similar experiments by Armsby at the Wisconsin experiment-station have given the opposite result; but in discussing these, the director, Prof. W. H. Jordan, shows that the apparent conflict is due to differences in the conditions of the experiments in the two cases. A similar advantage was found to result from the use of cottonseed-meal in fattening steers.

Professor Jordan's report is noteworthy for its clearness of statement and its scientific spirit. The experiments are planned with a definite purpose, and the results are discussed in a way to render them intelligible to any thinking farmer.

Annual report of the Maine fertilizer control and agricultural experiment-station, 1885-86. Augusta, State, 1886. 8c.